DRAFT INDOOR AIR QUALITY BUILDING STUDY PROPOSAL

1.0 INTRODUCTION

The purpose of the project is to assemble field data on exposure of occupants in office buildings that allow smoking to constituents of Environmental Tobacco Smoke (ETS) during the working day. The project will include the collection of area samples and personal exposure samples. The project will also include development of smoking lounge "packages" for various building system configurations.

The project is organized as three component studies. These include:

- A Pilot Study;
- A Ten Building Study; and
- A Smoking Lounge Study

This proposal describes the research protocol and provides a budget estimate for each component study.

2.0 PILOT STUDY

The Pilot Study will be conducted in two office buildings, with each building located in a different city. The buildings will be selected and access will be provided by the sponsor.

2.1 Background Information Collection

The design and operational characteristics of the HVAC systems in each building will be reviewed through (a) review of available mechanical plans; (b) walkthrough inspection; and (c) interviews with building operators. Smoking policies in both buildings will be reviewed and documented.

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2.2 Area IAQ Measurements

Fixed location area sampling will be conducted at five locations in each building. These locations will be selected to reflect different uses of the indoor environment (e.g. open plan offices, smoking areas, etc.). Sampling will be conducted for the following substances:

- **Nicotine** and **3-ethenyl pyridine** samples will be collected on an XAD-4 polymer and analyzed using a gas chromatograph equipped with a nitrogen selected detector.
- **Respirable Suspended Particles (RSP)** samples will be collected using gravimetric techniques.
- **Ultra-violet Particulate Matter (UVPM)** levels will be determined from the gravimetric samples. This approach allows an estimate of ETS-related particles using ultra-violet (UV) analyses.
- **Carbon dioxide** concentrations will be monitored continuously during the sampling period using integrated infrared analyzers/dataloggers.
- **Carbon monoxide** concentrations will be measured using direct reading electro-chemical analyzers.
- **Total Volatile Organic Compounds (TVOC)** samples will be collected using media such as charcoal or tenax and will be analyzed using gas chromatography.

TVOC sampling is now considered almost a necessity for credible IAQ studies. An added benefit is that the results will provide a scale for comparison of nicotine and 3-ethenyl pyridine measurements.

2.3 Personal Exposure Measurements

Personal exposure monitoring will be conducted for 20 persons in each building. Personal monitoring will include the following substances:

- **Nicotine**

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- **3-ethenyl pyridine**
- **Respirable Suspended Particles**
- **Ultra-violet Particulate Matter**

Personal sampling will require the sampling apparatus to be attached to individual subjects for an eight-hour work day. The apparatus will include light weight sampling pumps, a filter cassette and a glass sampling tube. We have explored the possibility of using passive sampling techniques for nicotine and 3-ethenyl pyridine. However, passive sampling and analytical techniques are not adequately sensitive to detect the low concentrations of the vapor phase constituents typically found in office environments over an eight-hour work day.

An activity log will be used to track activities and movements of each personal monitoring subject during the sampling period. The activity logs will be used to estimate the proportion of time that each subject is exposed to ETS during the working day. Selection criteria for the persons to be included in the personal monitoring program will be determined (e.g., sex, type of work and smoking status). The sponsor will provide a group of 20 pre-selected persons in each building who meet these criteria.

2.4 Pilot Study Reporting

The report will include results of the study, as well as recommendations for modifications to the Ten Building Study as required.

2.5 Pilot Study Time Frame

The Pilot Study could be completed over a two to three month period following initiation of the project.

3.0 TEN BUILDING IAQ STUDY

The Ten Building IAQ Study will commence upon the conclusion of the Pilot Study. Each of the ten buildings will be in different cities. The research protocols developed for the Pilot Study will be applied to the Ten Building Study.

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However, refinement of the protocols may occur as a result of experience gained through implementation of the Pilot Study.

3.1 Study Options

Three different scenarios for the data collection phase of the Ten Building Study have been developed and budgeted:

1. Personal monitoring of 20 subjects in each building to be conducted over one working day. Concurrently, area sampling will be undertaken at five indoor locations.

2. Personal monitoring of 50 subjects in each building conducted over a two-day period (25 subjects per day). Area sampling will be conducted at five locations each day (10 sites in total).

3. Personal monitoring of 100 subjects in each building conducted over a four-day period (25 subjects per day). Area sampling will be conducted at five locations each day (20 sites in total).

3.2 Reporting

An overall report will be prepared and submitted to the sponsor. This report will form the basis for the preparation of articles for peer review in engineering and scientific journals. A report may also be prepared for submission to OSHA.

3.3 Time Frame

The Ten Building IAQ Study can be completed in 8 - 9 months from the time of completion of the Pilot Study.

4.0 SMOKING LOUNGE STUDY

Three of the 12 buildings investigated during the Pilot and Ten Building Study will be selected for the development of smoking lounge configurations. The Smoking Lounge Study will involve the development of smoking lounge "packages" to install a smoking lounge in each building. This study will not, however, include actual construction.

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The packages will include three design options:

1. Negative pressure zoning;

2. Displacement ventilation; and

3. Separate exhaust

Our primary role in this part of the project would be to coordinate design, assess the design options and prepare a report. The actual design will be undertaken by mechanical engineers registered in the states in which the smoking lounges will be configured.

5.0 BUDGETS

Separate budgets have been developed for the Pilot Study and each of the three sampling scenarios for the Ten Building Study.

The budget for the Smoking Lounge Study provides an estimate of professional fees for the work conducted by Theodor D. Sterling and Associates (TDSA) Ltd. as project coordinator. The budget for the smoking lounge study does not include fees for the local mechanical engineers, or expenses such as travel and communications.

5.1 Pilot Study

Professional Fees	$36,600
Equipment (including rental of 50 personal sampling pumps)*	16,500
Laboratory Analysis	10,150
Travel	10,900
Miscellaneous Expenses (communications, etc.)	1,000
TOTAL BUDGET FOR PILOT STUDY	**$75,150**

* Also includes one-time costs for purchase of equipment that would be used during the Ten Building Study.

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5.2 Ten Building IAQ Study

Option 1: 20 personal samples over a one-day period in each building

Professional Fees	$155,750
Equipment (including rental of 50 personal sampling pumps)	35,000
Laboratory Analysis	40,500
Travel	54,500
Miscellaneous Expenses (communications, etc.)	2,500
TOTAL BUDGET FOR OPTION 1	**$288,250**

Option 2: 50 personal samples over a two-day period in each building

Professional Fees	$187,350
Equipment (including rental of 50 personal sampling pumps)	39,000
Laboratory Analysis	77,000
Travel	59,000
Miscellaneous Expenses (communications, etc.)	2,500
TOTAL BUDGET FOR OPTION 2	**$364,850**

Option 3: 100 personal samples over a four-day period in each building

Professional Fees	$214,350
Equipment (including rental of 50 personal sampling pumps)	42,000
Laboratory Analysis	121,000
Travel	68,000
Miscellaneous Expenses (communications, etc.)	2,500
TOTAL BUDGET FOR OPTION 3	**$447,850**

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5.3 Smoking Lounge Study

Out professional fees for project coordination and reporting are estimated to be $20,000 to $30,000.

6.0 PROJECT TEAM

The Project Team will be composed of three TDSA Ltd. staff members:

Elia M. Sterling	President
Chris W. Collett	Director of Environmental Research
James A. Ross	Senior Field Technician

All gathered samples will be analyzed using two accredited laboratories who have assisted us in previous ETS monitoring projects:

- Cantest Ltd., Vancouver, B.C.
- PowerTech Labs, Surrey, B.C.

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